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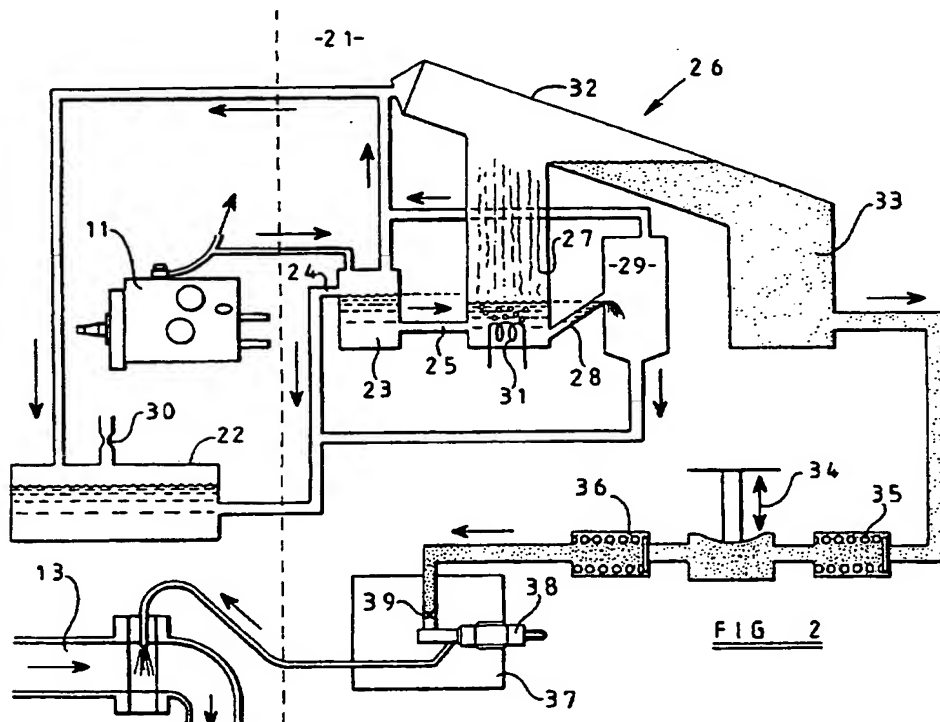
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GB 2159876 A EP 0441401 A1 US 5272873 A

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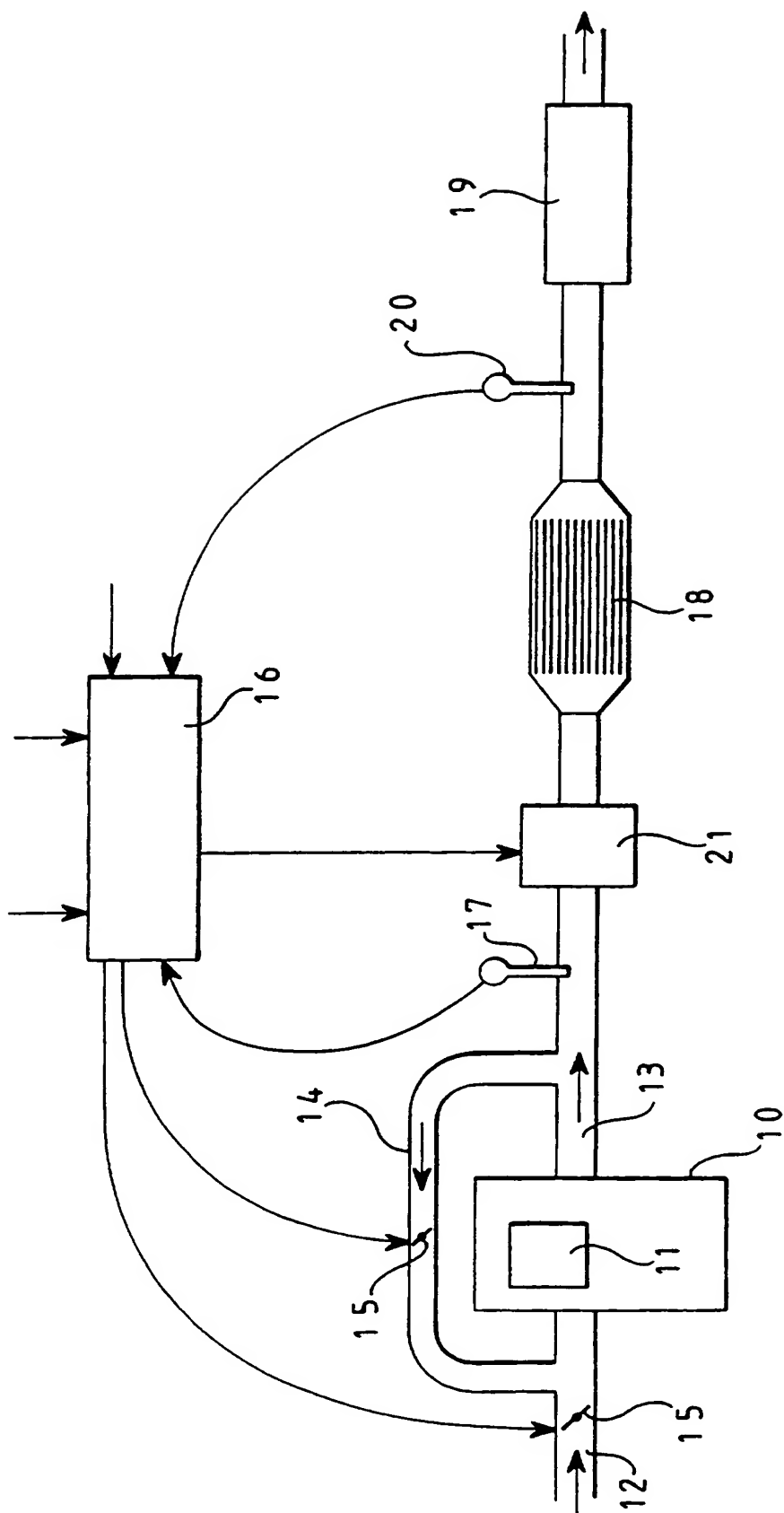
(54) Device for delivering gaseous hydrocarbon to an engine exhaust

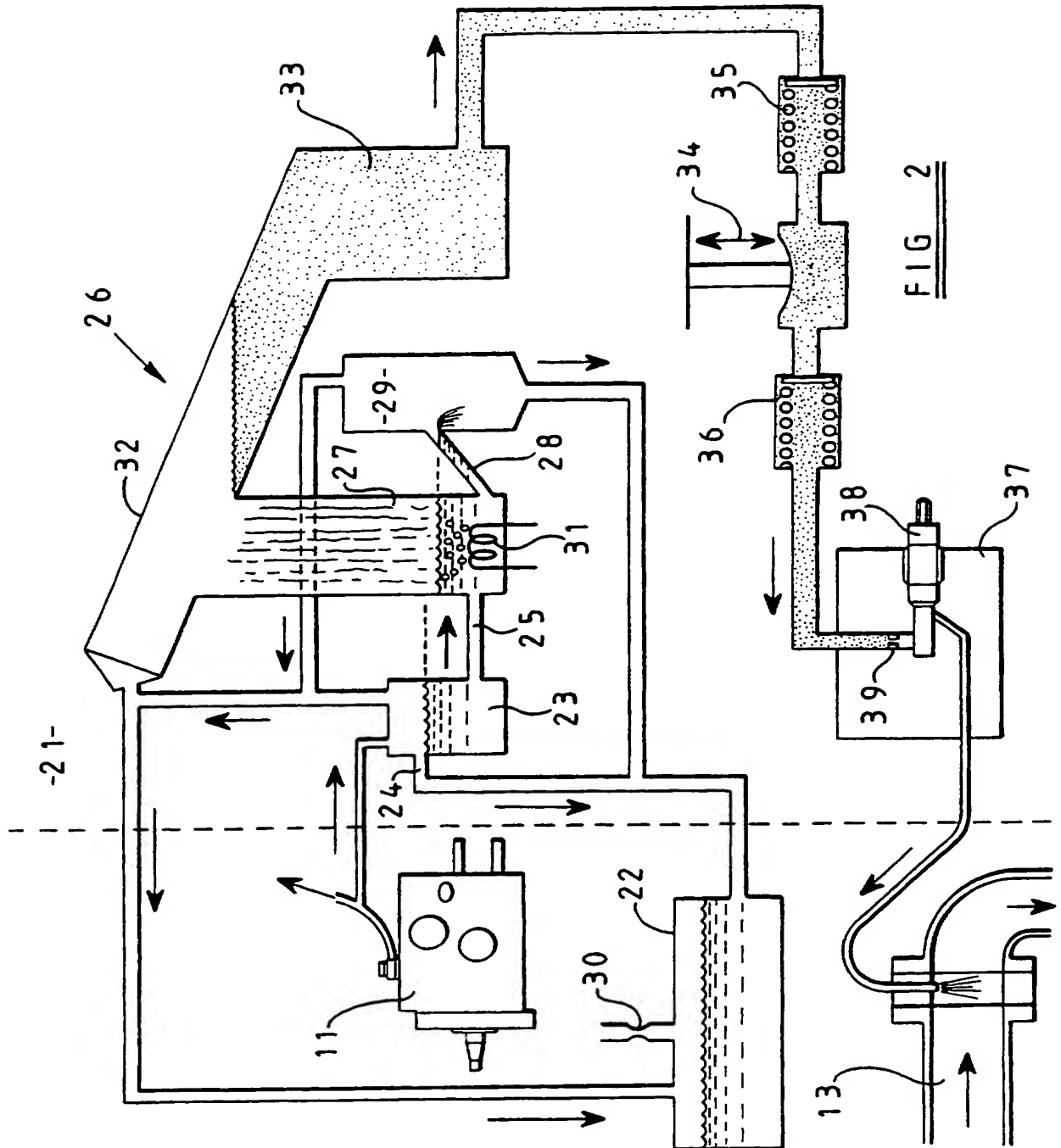
(57) A device for delivering gaseous hydrocarbon to an engine exhaust system includes a heater section (27) operable to deliver lighter fractions of a liquid fuel to a condenser section (26). The condensed lighter fractions of fuel are then pumped to a cracking and vaporising unit (37) which produces gaseous hydrocarbon for supply to the exhaust system.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1995

FIG 1



DEVICE

This invention relates to a device for generating small quantities of gaseous hydrocarbon for delivery into the exhaust system of a compression ignition engine upstream of a catalytic converter forming part of the system.

The action of the converter is to remove the NO_x produced during combustion of fuel in the engine, by conversion to water, carbon dioxide and nitrogen and for this purpose there must be an adequate amount of hydrocarbon in the exhaust gas flowing to the converter. A compression ignition engine is very efficient in the sense that under most operating conditions there is little unburnt hydrocarbon in the exhaust gas leaving the engine. As a result under certain engine operating conditions it is necessary to add hydrocarbon to ensure operation of the converter.

It would be possible to provide a reservoir for a suitable hydrocarbon for example propane, but this would be inconvenient in for example the commercial vehicle application.

The device to be described utilises engine fuel to produce the hydrocarbon required to enable the converter to function and will now be described with reference to the accompanying drawings in which:-

Figure 1 shows in diagrammatic form the engine and its exhaust system, and

Figure 2 shows in diagrammatic form the device for generating the hydrocarbon.

Referring to Figure 1 of the drawings there is shown at 10, a compression ignition engine which is provided with a fuel pump 11 for supplying fuel to the engine cylinders in turn. The air inlet of the engine is indicated at 12 and the exhaust outlet at 13. The inlet and outlet may be interconnected by an exhaust gas recirculation loop 14 associated with which are control valves 15 the positions of which are set by actuators controlled by an electronic control unit 16 which conveniently receives signals indicative of the engine speed, the ambient temperature and the setting of the throttle pedal of the vehicle. The control system also receives signals from a temperature sensor 17 which is located in the exhaust outlet of the engine but downstream of the branch forming the recirculation loop 14. The exhaust outlet 13 is connected to the inlet of a catalytic converter 18 and the outlet of the converter is connected in the usual way to a silencer 19. Downstream of the converter there is located a sensor 20 which is responsive to NO_x in the gasses leaving the converter and upstream of the converter is a hydrocarbon injection device 21 to be described.

Referring to Figure 2 of the drawings there is shown to the right hand side of the vertical dotted line, the components of the device 21.

Referring to Figure 2 there is shown the fuel pump 11 together with the fuel tank 22 from which the fuel pump 11 draws fuel through a pipe and filter not shown. The device 21 includes a reservoir tank 23 to which fuel is supplied from a leakage outlet of the fuel pump 11. The tank 23 is provided with an overflow 24 which is connected back to the fuel

tank 22 whereby the level of fuel in the reservoir tank is maintained at the level of the overflow 24. The tank 23 is coupled by way of a supply pipe 25, to a combined heater and condenser unit 26 which incorporates a heater section 27 into the base of which the fuel flows from the pipe 25. An overflow pipe 28 extends upwardly from adjacent the base of the heater unit into a chamber 29 the level of entry of the overflow pipe 28 into the chamber 29 being slightly lower than the level of the overflow pipe 24 so that the level of fuel in the heater section is lower than that in the reservoir tank. The base of the chamber 29 is connected back to the fuel tank and the upper portion of the chamber 29 as also is the upper portion of the reservoir tank, is vented back to the fuel tank 22. The latter is provided with an air vent 30 which in the particular example incorporates a restrictor.

Immersed in the fuel contained in the heater section 27 is an electric heating coil 31 and when this is supplied with electrical power the fuel in the heater section is heated and the lighter fractions of the fuel flow upwardly into the condenser section 32 of the unit 26. The condenser section incorporates a reservoir 33 in which the condensed lighter fractions of the fuel collect as liquid.

The condensed lighter fractions of fuel are withdrawn from the reservoir 33 by means of a pump 34 which may be of the diaphragm type and which incorporates inlet and outlet check valves 35, 36 respectively. The fuel leaving the pump is supplied by way of a restrictor 39 to a high temperature cracking and vaporising unit 37 and from the unit 37 the gaseous vaporised hydrocarbon is supplied to the exhaust system upstream of the catalytic converter 18. The cracking and vaporising unit incorporates a high temperature electrical heater 38.

In operation, the difference in the fuel levels within the reservoir tank 23 and the heater section 27 ensures that there is a continuous flow of fuel through the heater section 27 and this minimises the possibility of "coking" of the fuel within the heater section. Only the lighter fractions of the fuel are therefore vaporised in the heater section up to the capacity of the reservoir 33 and the remaining fuel is returned to the fuel tank. The amount of distillate removed from the fuel supply will be in practice, insignificant as compared with the volume of fuel in the tank so that the performance of the engine will practically be unaffected. The electronic control unit 16 controls the operation of the heaters 31 and 38 and also the pump 34 so that the hydrocarbon is only supplied to the exhaust system when it is required.

CLAIMS

1. A device for generating small quantities of gaseous hydrocarbon for delivery into the exhaust system of an internal combustion engine upstream of a catalytic converter forming part of the exhaust system, the device comprising a heater section in which liquid fuel is heated to drive off the lighter fractions of the fuel, a condenser for condensing said fractions, a cracking and vaporising unit to which the condensed lighter fractions of fuel are delivered and means for conveying the cracked and vaporised fuel to the exhaust system.
2. A device according to Claim 1, including a pump operable to deliver the condensed lighter fractions of fuel to the cracking and vaporising unit.
3. A device according to Claim 1 or Claim 2, in which the heater section and the cracking and vaporising unit each include an electrically powered heater.
4. A device for the purpose specified comprising the combination and arrangement of parts substantially as hereinbefore described with reference to Figure 2 of the accompanying drawings.

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Patents Act 1977
Examiner's report to the Comptroller under Section 17
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Relevant Technical Fields

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 C5E EAP

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Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASES: WPI

Search Examiner
 ALAN KERRY

Date of completion of Search
 21 FEBRUARY 1996

Documents considered relevant following a search in respect of Claims :-
 1-4

Categories of documents

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| <p>X: Document indicating lack of novelty or of inventive step.</p> <p>Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.</p> <p>A: Document indicating technological background and/or state of the art.</p> | <p>P: Document published on or after the declared priority date but before the filing date of the present application.</p> <p>E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.</p> <p>&: Member of the same patent family; corresponding document.</p> |
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Category	Identity of document and relevant passages	Relevant to claim(s)
X	EP 0441401 A1 (TOYOTA) see Claims 1, 2, 7-10; page 7, line 2 - page 8, line 4	1
A	US 5272873 A (HONDA) see Claim 1	
A	GB 2159876 A (FRYER) see Claim 1	

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).